# RECEIVING APPARATUS AND DECODING METHOD THEREOF

## CROSS-REFERENCE TO THE RELATED APPLICATIONS

[0001] This application claims priority from U.S. Provisional Application No. 62/243,246 filed on Oct. 19, 2015 and Korean Patent Application No. 10-2016-0134560 filed in the Korean Intellectual Property Office on Oct. 17, 2016, the disclosures of which are incorporated herein by reference in its entirety.

## BACKGROUND

[0002] 1. Field

[0003] Apparatuses and methods consistent with the exemplary embodiments relate to signal reception and decoding, and more particularly, to receiving and decoding a layered division multiplexing (LDM) signal.

[0004] 2. Description of the Related Art

[0005] In the information society of the 21st century, a broadcasting communication service is welcoming the time of full-scale digitalization, multi-channelization, broadband, and high quality. In particular, as a supply of high-definition digital television (TV), personal medial player (PMP), and a portable broadcasting device is recently expanded, a demand for a support of various reception systems of a digital broadcasting service is also increased.

[0006] Meanwhile, since an environment required by a system is diverse such as in the case in which signal latency is important or performance is important, it is requested to find a method for processing an LDM signal in the diverse environment.

## SUMMARY

[0007] Exemplary embodiments may or may not overcome the above disadvantages and other disadvantages not described above. Also, the exemplary embodiments are not required to overcome the disadvantages described above.

[0008] The exemplary embodiments provide a receiving apparatus capable of efficiently processing an LDM signal, and a decoding method thereof.

[0009] According to an exemplary embodiment, there is provided a receiving apparatus receiving and processing a layered division multiplexing (LDM) signal which may include: a first decoder configured to decode a signal transmitted through a first layer from the LDM signal using a parity check matrix to generate low density parity check (LDPC) information word bits and parity bits; an encoder configured to encode the LDPC information word bits, generated by decoding the signal transmitted through the first layer, using the parity check matrix to generate parity bits corresponding only to preset columns in the parity check matrix; and a second decoder configured to decode a signal obtained by removing, from the LDM signal, a signal corresponding to the LDPC information word bits generated by decoding the signal transmitted through the first layer, the parity bits generated by the encoder, and the parity bits generated by the first decoder except the parity bits generated by the encoder, thereby to generate information word bits transmitted through a second layer.

[0010] The preset columns may be columns having a degree of 1 in the parity check matrix.

[0011] The parity check matrix may include a first parity check matrix including a first information word partial matrix and a first parity partial matrix, which is a dual diagonal matrix, and a second parity check matrix including a second information word partial matrix and a second parity partial matrix, which is a unit matrix, and the encoder may generate the parity bits corresponding only to the columns having the degree of 1 in the parity check matrix.

[0012] The first decoder may decode the signal transmitted through the first layer from the LDM signal using a first LDPC decoder, and decode the LDPC information word bits, corresponding to the signal transmitted through the first layer, using a first Bose, Chaudhuri, Hocquenghem (BCH) decoder to generate information word bits transmitted through the first layer.

[0013] The encoder may encode the LDPC information word bits, corresponding to the signal transmitted through the first layer, using an LDPC encoder to generate the parity bits corresponding only to the preset columns in the parity check matrix.

[0014] The encoder may encode the information word bits, transmitted through the first layer, using a BCH encoder to generate the parity bits, and the LDPC encoder may encode the information word bits transmitted through the first layer and the BCH parity bits to generate the parity bits corresponding only to the preset columns in the parity check matrix.

[0015] The second decoder may decode the signal obtained by the removing to generate LDPC information word bits and parity bits, corresponding to a signal transmitted through the second layer, using the first LDPC decoder, and decode the LDPC information word bits, corresponding to the signal transmitted through the second layer, using the first BCH decoder to generate the information word bits transmitted through the second layer.

[0016] The second decoder may decode the signal obtained by the removing to generate th LDPC information word bits and parity bits, corresponding to a signal transmitted through the second layer, using a second LDPC decoder, and decode the LDPC information word bits, corresponding to the signal transmitted through the second layer, using a second BCH decoder to generate the information word bits transmitted through the second layer.

[0017] According to an exemplary embodiment, there is provided a decoding method of a receiving apparatus receiving and processing an LDM signal. The method may include: decoding a signal transmitted through a first layer from the LDM signal using a parity check matrix to generate LDPC information word bits and parity bits; encoding the LDPC information word bits, generated by decoding the signal transmitted through the first layer, using the parity check matrix to generate parity bits corresponding only to preset columns in the parity check matrix; and decoding a signal obtained by removing, from the LDM signal, a signal corresponding to the LDPC information word bits generated by decoding the signal transmitted through the first layer, the parity bits generated by the encoding, and the parity bits generated by the decoding except the parity bits generated by the encoding, thereby to generate information word bits transmitted through a second layer.

[0018] The preset columns may be columns having a degree of 1 in the parity check matrix.

[0019] The parity check matrix may include a first parity check matrix including a first information word partial